

Project Title:

Observations of the Magnetic Free Energy in Active Regions: the Energization of Solar Activity

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Project Information:

The magnetic field permeating the solar atmosphere governs much of the structure, morphology, brightness and dynamics observed on the Sun. The magnetic field, especially in active regions, is thought to provide the power for energetic events in the solar corona, such as solar flares and Coronal Mass Ejections (CME) and is believed to energize the hot coronal plasma seen in EUV or X-rays. The question remains what specific aspect of the magnetic flux governs the observed variability; we propose that to directly understand the role of the magnetic field in energizing the solar corona, it is necessary to measure the free magnetic energy available in active regions. We have now demonstrated (with support from a previous NASA grant) the feasibility of making temporally resolved measurements of the magnetic free energy above active regions. We have shown that the chromospheric magnetic flux vector, measured high enough above the photosphere so that the magnetic field is force-free, renders the magnetic virial theorem applicable. We are now in a position to fully exploit this new tool. The goal is to determine the physical changes which cause variations in the magnetic free energy. Ultimately, we hope to make advance predictions of solar activity by observing variations in the available magnetic energy.

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